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III. "On the Intensification of Sound through Solid Bodies by the interposition of Water between them and the distal extremities of Hearing-Tubes." By S. SCOTT ALISON, M.D., Assistant-Physician to the Hospital for Consumption. Communicated by Dr. TYNDALL. Received January 20, 1859.

(Abstract.)

In this Paper the author gives an account of various experiments which he has recently made on sounds proceeding through solid bodies. He has found that sounds which are faint, when heard by a hearing-tube applied directly to solid sounding bodies, become augmented when water is interposed between these bodies and the distal extremity of the hearing-tube. He has been able, by the employment of water, to hear the sound of a solid body, such as a table, which, without this medium, has been inaudible. Experiments have been made upon water in various amounts and in different conditions. Thus a very thin layer, a mere ring round the edge of the hearing-tube, masses of water in larger or smaller vessels, and a bag of water, have been employed. The results have been the same as regards augmentation. The degree of augmentation was greatest when the hearing-tube was immersed freely in water. In experimenting upon water in vessels, it was found necessary to close the extremity of the tube to be immersed, by tying over it a piece of bladder or thin india-rubber; for the entrance of water into the interior interfered greatly with the augmentation.

The effect of water in augmenting sound is materially reduced if even a small amount of solid material be interposed between the water employed and the mouth of the hearing-tube. A piece of wood, not much thicker than a paper-cutter, materially interferes with the augmenting power of water.

The augmentation of sound thus obtained by water seems to be due to the complete fitting of the liquid on the solid body and also round the mouth of the hearing-tube, whereby the column of air is thoroughly enclosed; also to the less impediment to the vibrations of the instrument when held in contact with water, than when held

in contact with a solid body, the water yielding in a greater degree than a solid.

The mode of judging of the augmentation was twofold: 1st, one sensation was compared with another perceived by the same ear, the one sensation following immediately upon the other; 2nd, the differential stethophone was employed, by which two impressions are simultaneously made upon the two ears; in which case, if one impression be materially greater than the other, sound is perceived in that ear only on which the greater impression is made. To obtain the advantage of the differential stethophone,—or “Phonoscope,” as it might here perhaps be more correctly designated—when sounds at some distance from the ear were being examined, its length was increased by the addition of long tubes of india-rubber.

Experiments were made upon other liquids besides water, such as mercury and ether.

Other materials besides liquids were found to afford a similar intensification of sound from solid bodies, such as laminæ of gutta-percha, or of india-rubber, and sheets of writing paper, but the amount of augmentation was less.

The hearing-tubes employed were various. Many of the experiments were performed with the author's ordinary differential stethophone, an instrument described in No. 31 of the ‘Proceedings of the Royal Society.’ India-rubber tubes fitted with ivory ear-knobs, and with wooden or glass cups (the size of the cup or object-extremity of ordinary stethoscopes), and having an ear-extremity to pass into the meatus, and brass tubes, were also in turn employed. Tubes closed at their distal extremity with solid material, such as glass, did not answer so well as those closed with membrane.

The water-bag increases the impression conveyed to the ear by the wooden stethoscope, if it be placed between the flat ear-piece and the external ear. It may be employed alone to reinforce sound. The name of Hydrophone has been given to it.

A postscript is added, in which the author records an experiment made on the bank of the Serpentine river. A sound produced upon the land was heard at a point in the water when it could not be heard at an equal distance on the ground, if the two limbs of the differential stethophone were employed simultaneously.

The sensation upon the ear, connected, by means of a hollow tube,

with water in sonorous undulations, was found to be much greater than that upon the ear connected with the same water by means of a solid rod. When both tube and solid rod were employed simultaneously, sound was heard in that ear only supplied with the tube

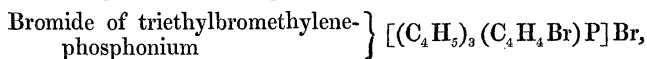
*February 24, 1859.*

Sir BENJAMIN C. BRODIE, Bart., President, in the Chair.

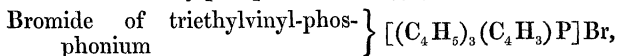
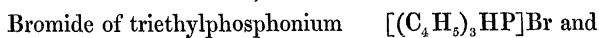
The following communications were read:—

- I. "Researches on the Phosphorus-Bases."—No. V. Diphosphonium - Compounds. By A. W. HOFMANN, LL.D., F.R.S., &c. Received January 20, 1859.

In a note\* on the department of dibromide of ethylene with triethylphosphine, I have stated that the reaction between these two substances gives rise to the production of



whilst two other bromides, viz.



are generated in consequence of secondary processes. But I did not fail to remark in the same note, that in addition there is formed in this reaction a fourth bromide, the nature of which, at that time, I had been unable to fix by experiment.

I have continued the study of this substance, which has led to the following results.

All attempts to eliminate the bromide in question by frequently recrystallizing the direct product of the action of dibromide of ethylene on triethylphosphine have entirely failed. Considerable sacrifice of precious material and often repeated analyses of the different crops of crystallization taught me nothing, except that the body

\* Proceedings, vol. ix. p. 287.